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The Solar Ocean Energy Liaison

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OCEAN ENERGY Liaison

INCORPORATING
The OTEC Liaison

VOLUME 3 NUMBER 11
November 1979

LOTS OF HOT ACTIVITY IN CONGRESS ON OTEC... ... BUT DOE SAYS COOL DOWN, SLOW IT DOWN

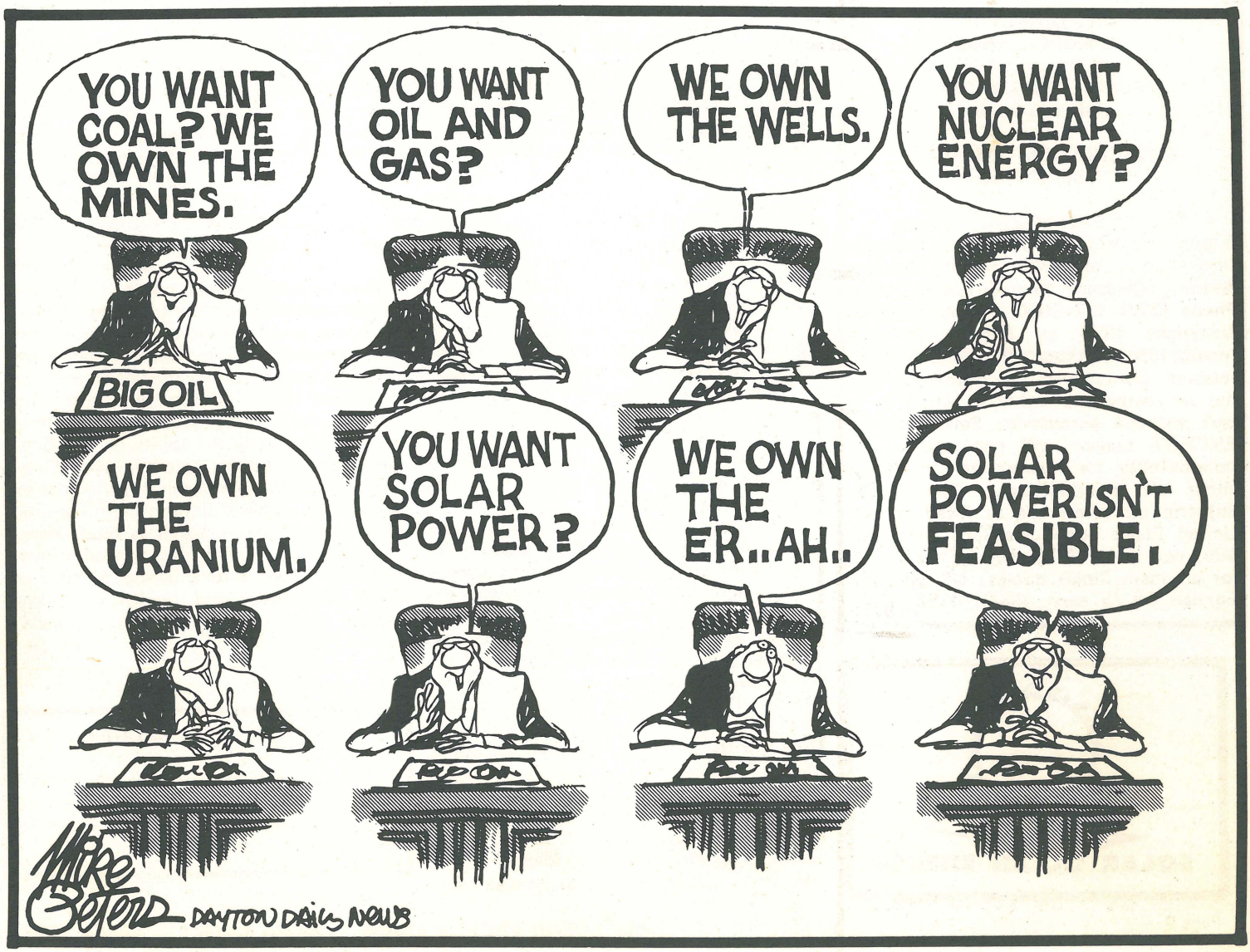
Who Tells DOE What To Say?

Since the editor of this newsletter became involved in OTEC, over three years ago, rumors have often been heard as to the reasons behind the turtle-like movements of the OTEC program. Most frequently, it was the mysterious "powers that be" that were purposely hamstringing the rapid development and implementation of solar ocean energy as a partial but substantial alternative to conventional sources of energy such as nuclear, oil, and coal. Other solar technologies have had similar experience. (The cartoon reproduced on this page, in fact, is used regularly in the literature of the Solar Lobby.)

Jacques Cousteau, in a letter to President Carter, expresses surprise that solar ocean energy is "systematically omitted from federal or presidential plans" (see complete text published in OE). His comment echoes the rumors we have heard for years.

But an apparent confirmation of those views was expressed in the testimony of Dr. Bennett Miller, Program Director of Solar, Geothermal, Electric, and Storage Systems of the US Department of Energy, before Senator Matsunaga's committee on Senate Bill S. 1830 October 15th, saying that "DOE believes the bill is not needed at this time." (Miller's complete statement appears elsewhere in this issue.)

(continued on Page 3)



Solar
OCEAN ENERGY
Liaison

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The OTEC Liaison

AN INTERNATIONAL NEWSLETTER ENGAGED AS LIAISON FOR ALL FORMS OF SOLAR ENERGY FROM THE SEA, INCLUDING:
OTEC
(OCEAN THERMAL ENERGY CONVERSION)
WAVE - TIDAL - CURRENT
OFFSHORE WIND - BIOMASS
SALINITY GRADIENTS

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SOLAR OCEAN ENERGY

JAPAN PROCEEDS WITH OTEC DEMONSTRATION PROJECT

A sketchy but reliable report has been received by OCEAN ENERGY that Japan is currently proceeding with its version of Mini-OTEC. The demonstration plant, designed to produce 100 kilowatts (twice the gross energy production of Hawaii's Mini-OTEC) will be built off the Japanese island of Naru, with expected start-up in the summer of 1981. Two firms, the Tokyo Electric Power Company and Todensaki, are involved, with an estimated cost of on billion yen.

More complete details are enroute to us and will be published in our December or January issue.

JAMAICAN INTEREST IN OTEC WARMING UP

Two Natural Resources Present in Abundance

This publication has run several articles on the interest of the Jamaican Government in OTEC, including a quote from that country's Ministry of Mining and Natural Resources: "We are naturally interested in OTEC as being perhaps the only solar-energy technology with baseload applications."

The Jamaican Government has been observing OTEC's progress for an obvious reason: Most of the world's major aluminum companies have major plants in Jamaica mining bauxite, the raw material from which aluminum is made. Jamaica has bauxite in abundance.

Moreover, the production of aluminum requires extraordinary amounts of electric power—4% of all US industrial electric usage, in fact.

But Jamaica also has another natural resource in abundance: one of the highest OTEC delta-Ts in the world, just offshore.

Due to the increasingly high costs of power in the US, the major aluminum producers are seeking cheap power. They are particularly considering Africa and South America, both of which possess low-cost hydroelectric power.

The possibility, then, of OTEC power plants off the Jamican coast, adjacent to the mountains of bauxite, seems ideal—and is apparently being pursued with increasing vigor recently.

But Jamaica continues to have intense internal political problems, evidenced recently by the stepped-up attempts of Jamaican Prime Minister Manley to muzzle that country's only remaining source of free speech, the over-100-year-old newspaper *The Gleaner.*

Political problems aside, the dual resources in Jamaica should encourage aluminum firms, major OTEC contractors, and offshore construction companies to pursue the potential of such a three-way marriage.

WAVES POWER FRESH WATER FROM OCEAN SYSTEM

Energy from waves is being used to power a system which removes the salt from sea water, making it fit for human consumption.

The system being developed by the Delaware Sea Grant Program is one of 25 projects supported by a $964,000 grant from the National Oceanic and Atmospheric Administration (NOAA) announced by Richard A. Frank, Administrator of the Commerce Department agency.

Scale models of the system have been tested in the laboratory and at sea, and future research under the Sea Grant will undertake the construction and testing of a model to generate 1500 gallons of fresh water per day from the sea.

A unit of that size, say the researchers, could provide enough fresh water for coastal communities of about 500 persons. Moreover, the device's design permits it to be built economically and to be operated for long periods of time without significant maintenance.

The desalination system uses a molecular filtration technique known as reverse osmosis, in which waves power a high-pressure pump that filters out substances like sodium and chlorine but permits water molecules to pass through.

The NOAA grant, which has been augmented by $761,641 in funds from the State, the University of Delaware, and industry, also will support studies in ocean engineering, marine-resource utilization, and marine environmental systems, according to Dr. William S. Gaither, Director of the Delaware program.

The ocean-engineering projects include a geological study of the near-shore zone of the western part of Delaware Bay, and a mathematical simulation model of the response of the shoreline to storms.

In the area of resource utilization, the Delaware scientists are investigating the use of chitin from the outer shell of crabs, lobsters, and other invertebrates for healing wounds, for making packaging for films, and for improving the ability of intestinal bacteria to digest the lactose in whey. They also are studying biochemical techniques to control the oyster drill, and the suitability of some salt-marsh plants as food crops.

In addition, a pilot plant for the culture of oysters over a long period of time is being developed, and several ecological studies of salt marshes are being made.

OTEC-1 OVER BUDGET

Various estimates ranging from $4.5 million to $5.5 million are understood to be the scope of the cost overrun for the OTEC-1 project.

(continued from Page 1)

The reaction of Senators Matsunaga and Tsongas to Miller's statement was quite vivid, including Matsunaga's comment that "DOE had better get on the ball and take advantage of what is already here and go. If DOE refuses to do it, then Congress is going to force it to do it. And this is why we introduced the bill. We saw a bit of foot-dragging on the part of DOE. If DOE cannot agree with us, we will have to carry the ball."

Senator Tsongas also commented, referring to DOE personnel as "having their own team of commanders that they have to deal with at OMB (the Office of Management and Budget), and yet those people never come down here to testify."

Thus, it appears that it is not necessarily DOE alone that is doing the "foot-dragging", but that they are being directed from above by "the powers that be", an allusion to the OMB and the Carter Administration itself.

OCEAN ENERGY has published the complete dialogue between DOE's Miller and Senators Matsunaga and Tsongas herein. We leave it to our readers to draw their own conclusions.

The Statement That Caused the Furor

MILLER'S/DOE'S STATEMENT

The following is a direct quotation from the statement of Dr. Bennett Miller, Program Director, Solar, Geothermal, Electric and Storage Systems of the Department of Energy, given before the Subcommittee on Energy Research and Development, Committee on Energy and Natural Resources, United States Senate, on October 15th, 1979.

Dr. Miller's prepared statement included six pages referring to the current OTEC program of DOE. This testimony, with that of others, was presented as background to Senator Spark Matsunaga's Bill S. 1830. The following excerpt is of the full last two pages of Miller's eight-page testimony. Its content precipitated the dialogue between Miller and Senators Matsunaga and Tsongas, which can be found elsewhere in this issue.

With the above as background, I would like now to turn to our position on S. 1830. DOE believes that the Bill is not needed at this time because the Bill's provisions basically duplicate our present program plans, with some minor revisions.

The principal difference between the Bill and our plans is that the Bill provides for parallel development, while our plans call for several developments in which the results of each experiment are used in planning the next.

While this process generally takes longer to reach a given stage of development than the parallel approach, it does minimize the cost and risk. For example, our plans call for one pilot plant at a cost of $180 million, while the Bill calls for multiple pilot plants at a cost of about $580 million in order to acquire the information needed to decide® on a commitment to proceed with parallel developments at the demonstration-plant site.

The Bill requires that a plan for the commercialization of the OTEC process be prepared. So does the DOE plan, and it is scheduled for completion in FY 1983.

The Multi-year OTEC Development Plan, which should be finished in early January 1980, contains the data required in Section 2 of the proposed Bill. Risk assessments will be made during both the concept-definition and the preliminary-design phases of the OTEC development as a continuous and iterative process.

Finally, we take the position that it is premature to set OTEC production goals before we have demonstrated that the OTEC heat exchangers can be cleaned and the required heat-transfer coefficient maintained in an at-sea environment, at an acceptable cost. This demonstration, as I have stated, is the purpose of OTEC-1. Those results will be available in September 1980. Enactment of this legislation before these critical data are obtained would mean the loss of program flexibility, so necessary in dealing with rapidly changing developments in ocean thermal energy conversion.

In short, Mr. Chairman, the proposed intent of the Bill is to be commended, and is supported by the Department of Energy. But at this time, in light of the present state of development, it would seem somewhat premature to lock ourselves into a specific development pattern. Rather, we would prefer to maintain flexibility over the next year or so to respond to the results from OTEC-1.

This concludes my prepared remarks. Thank you.

DIALOGUE BETWEEN DOE'S BENNETT MILLER AND SENATORS MATSUNAGA AND TSONGAS

Following are direct quotations from the official transcript of The Congressional Record which will not be published until late December.

The conversation reported below followed the presentation of the written and oral statements by those invited to give testimony before the committee headed by Senator Matsunaga in conjunction with the presentation of his bill. (See related story in this issue.)

The portion of Bennett Miller's testimony to which this dialogue refers appears elsewhere in this issue.

Senator Matsunaga: Thank you very much, Mr. Miller. Mr. Miller, on Page 7 of your testimony, you state that DOE believes that the bill is not needed at this time, because the bill's provisions basically duplicate your present program plans with minor revisions.

It seems to me that inasmuch as we have had a breakthrough with Mini-OTEC, and as you say, without the use of federal funds even, and we know that areas such as Puerto Rico, Hawaii, and the Bay Area provide the environment which could be used to accelerate this program, I would think that DOE would be flexible enough, and I have to note that in your statement you say that you would prefer to maintain flexibility over the next year or so.

HAWAIIAN OTEC TEAM FORMED

The Hawaiian Electric Company Incorporated, Westinghouse Electric Corporation, the Dillingham Corporation, Gibbs and Hill Incorporated, and Root Development Incorporated have formed a team to seek a US Department of Energy contract for the design, construction, and operation of an Ocean Thermal Energy Conversion (OTEC) pilot plant, according to Hawaiian Electric President Carl H. Williams.

The OTEC pilot plant is the next step in the Department of Energy's OTEC development program, and is currently estimated at $140 million. This project calls for the development of a complete OTEC pilot power-plant installation of a size that will be of interest to electric utility companies. It is the next major phase of the OTEC test program which will follow the 50-kilowatt Mini-OTEC project and OTEC-1, a 1-megawatt project, both to be deployed in Hawaii.

"We are very pleased to be working in concert with the efforts of the State Government to develop OTEC as an alternative energy source for the people of Hawaii and the nation," said Williams. "We are optimistic about our chances for getting the OTEC pilot-plant contract. Our team has valuable practical experience in the Ocean Thermal Energy Conversion field, and Hawaii is the acknowledged leader in the development of this emerging form of alternative energy."

Williams cited Hawaii's nearly ideal location with its close proximity to significant ocean depths, warm surface water, and stable weather conditions. Also included in the factors favoring Hawaii, said Williams, is rhe experience gained in working with the OTEC test-support systems already in place from earlier projects, and the experience that will be gained in other projects planned for Hawaii in the very near future.

Recently, Hawaii Governor George Ariyoshi wrote to the Secretary of the Department of Energy offering to share in the pilot plant if it is located in Hawaii. Governor Ariyoshi pointed out that Hawaii has contributed to the development of OTEC for more than five years and is now the world leader in OTEC research.

I would strongly urge that the bill's program of parallel programs be carried out. Here is something that can be developed. As you know, the President has committed the Administration to solar energy, and this is up to 20% of energy production, particularly in the area of electricity.

My question to you is: Is the Department at this time reporting on a policy decision to restrict the next increment to one demonstration plant?

Mr. Miller: Mr. Chairman, it is our feeling that we have to assess, after the results of OTEC-1, what direction we should take. Even before those results, we are prepared to essentially plan for a pilot plant followed by a demonstration plant. I would think that if OTEC-1 were as successful as most of us believe it will be, we would be more than willing to reassess how much in the way of a parallel development program we would go forward with.

At the moment, everything seems to come together in our view with OTEC-1: the first time we really put things together on a big enough scale to understand the systems-integration questions. I would feel very strongly that one year from now, if we have the kind of results that I think, we will be proposing a much more aggressive program.

Senator Matsunaga: Well, I have to learn of your flexibility in this regard. I think if you want to be guided by the success or failure of the experiments which will be conducted both in Hawaii and in other areas—and I say Hawaii because we have truly had a breakthrough in the area of OTEC in Hawaii—I think we ought to go full-speed ahead.

We went to the Moon, and we should be able to leave OTEC plants on Earth before 1985—in the next five years.

At this point Senator Matsunaga turned the questioning over to Senator Tsongas.

Senator Tsongas: Mr. Miller, you are also responsible for the wind program as well, are you not?

Mr. Miller: Yes, sir.

Senator Tsongas: How would you characterize OTEC in comparison with the state-of-the-art technology of wind-energy photovoltaics?

Mr. Miller: That is always a very difficult question. It is my belief that the technology of wind systems is probably more advanced than OTEC. If we begin to compare OTEC with photovoltaics, it becomes a very difficult comparison.

I personally believe that OTEC is a sleeper: that it has an awful lot of potential that generally has been unappreciated because that technology is so different from what we have been taught as technologists to expect.

It violates almost all of the principles we have been taught. It operates on low temperature differentials, it operates in at-sea environments which we know are notoriously difficult, and yet we are answering the key questions.

I see OTEC as a sleeper. I cannot compare it with photovoltaics, because photovoltaics is a technology we can deploy now in the megawatt range. OTEC is a difficult comparison to make; and I think with respect to OTEC and wind, wind technology is far advanced at the moment.

Senator Tsongas: I am intrigued by the use of the word "sleeper", which is not a technical term. In political terms it means under-funded. (applause)

Some mundane non-funding questions were asked at this point.

Senator Tsongas: One of the arguments on wind energy that you hear from industry is that if you are going to get these things put in place, they will be utilized by utilities; and the only way the utility is going to have confidence in the system is if you have more than one demonstration plant—if you have a number of them—so you have kind of a collective judgment that comes out of them. Why does that not also pertain to OTEC?

Mr. Miller: It might very well. I think before OTEC really begins to penetrate the marketplace, you are going to have to see more than one demonstration. I don't think one would do it. But already, before you start deploying three or four, you do have to build one.

I would think multiple OTECs would follow the first demonstration pretty rapidly.

Senator Tsongas: I can understand OTEC-1, since this is the first time you have put the components together. But from that point on, why would you not want to have second-source demonstration other than the obvious fiscal rationale?

Mr. Miller: If OTEC-1 is really wildly successful, I think we would rethink whether we would go on a serial path—namely, building one pilot plant followed by demonstration building—versus building multiple pilots; but we won't know that for another year. That is why I feel we should wait until we get the results from OTEC-1. It's a big step up: OTEC-1 is a factor of 20 times the size of Mini-OTEC, and the pilot plant would be a factor of 10; and when you begin to scale things by a factor of several hundred, you know you will run into problems. There is no question about that. I think they are tractable problems, but we don't know that yet.

Senator Tsongas: What you don't know is whether those problems are peculiar to that plant or endemic of the system. Maybe one possible compromise between the bill and the Administration's position is to allow the serial approach for OTEC-1, and from that point on mandate a systems approach.

When you consider what we are putting into some of these other sources of energy, I for one would rather err on the side of duplication given the fact that this country has the crisis we are talking about.

Senator Matsunaga: I might point out that OTEC-1 pertains only to experiments and development of heat exchangers. Is that not so?

Mr. Miller: OTEC-1 is basically a heat-exchanger test facility, but would have to have a 3,000-foot-long cold-water pipe, which would be the longest one of that size that we will deploy.

We have a mock-up of an electricity producer on board, so that you do begin to put all the systems together: all the pumps and evaporators and condensers. But ba-

A PUBLIC APOLOGY TO MR. D'ARSONVAL... OR, BOY—HAVE WE ALL BEEN WRONG!

All of us involved in the OTEC program have done a great disservice to the man who started it all almost a hundred years ago—Arsene d'Arsonval. That's right—*Arsene*... not Jacques.

In virtually all the literature on OTEC—from the major contractors such as Lockheed, TRW, and Sea Solar Power, as well as in the published papers of DOE, SERI, and this publication, we have given poor Mr. D'Arsonval an incorrect first name.

In a letter dated October 9th, 1979 from Jacques (!) G. Richardson, Editor of *Impact of Science of Society,* a publication of UNESCO in Paris, he says:

We have carefully checked all available references concerning the correct first name of the French biophysicist d'Arsonval. D'Arsonval had only one first name, which was Arsene. We find no encyclopaedic sanction or bibliographic mention of Jacques as a first name for this scientist. Perhaps the misnomer is similar to that of "Nicolai" Lenin, whom some historians continue to misidentify in place of his correct first name, Vladimir I.

The staff of *Ocean Energy* have also checked this out to find that Arsene is correct.

Thus, we ask all of you to make the correction with the next printing of your literature. The least we can do for the man who originated the OTEC concept is to get his name right!

Again, we thank Anne White in Hawaii for bringing this to our attention. Her husband, Hank, Operations Manager of the Natural Energy Laboratory of Hawaii, has written several articles on OTEC, as has Anne for several French publications. It was the publication of these articles that brought this misnomer to light.

[Editor's note: The above article was mentioned in passing prior to publication to Don Petty of SERI's Ocean Energy Division, and Don said that he had a copy of d'Arsonval's original paper. Sure enough, the paper—dated 1881—is signed "Dr. A. d'Arsonval"!]

DIALOGUE BETWEEN DOE'S BENNETT MILLER AND SENATORS MATSUNAGA AND TSONGAS

(continued from Page 4)

sically it is designed in terms of what we would test to be modular with respect to heat exchangers.

We can take out the heat exchangers and put something else in, but we cannot take out the cold-water pipe.

Senator Matsunaga: I am inclined to disagree with you on that. I think we will have testimony from people involved in the experiment. I doubt very much that OTEC-1 involves more than just experimentation and development of heat exchangers. This is far from what OTEC has gone into—what OTEC-10, OTEC-40, OTEC-100, or whatever it is will be going into.

My concern—and I am sure Senator Tsongas shares this concern—is that the use of the term "sleeper" is an indication that DOE feels that it is something for the future.

I know that it is something for today—that it is here and now. DOE had better get on the ball and take advantage of what is already here and go. If DOE refuses to do it, then Congress is going to force it to do it. And this is why we introduced the bill. We saw a bit of foot-dragging on the part of DOE. If DOE cannot agree with us, we will have to carry the ball.

As a member of the Energy Committee and as Acting Chairman and Vice-Chairman of the Subcommittee on Research and Development, I am going to do my darnedest to see that DOE does get on the ball and take this matter seriously, because this is one of the biggest, most promising programs.

Senator Tsongas: Mr. Chairman, if I might interject: It has been my experience that I always find it a little difficult putting those DOE personnel who are sort of on the technical cutting edge of the research under this. I have always found them to be most excited about technology, and yet they have their own team of commanders that they have to deal with at OMB, and yet those people never come down here to testify.

That is the nature of the beast, and that is what we have to live with. I think within the technical community, OTEC is something people are excited about, with a number of other possibilities. I would suggest that if we ever took OTEC to the Senate floor, we would win; and the Administration should be aware of that.

If there is not the commensurate support of your idea, then you obviously, in my opinion, could win it on the Senate floor. I would like to indicate my support for what you are doing.

US GOVERNMENT PROCUREMENT INVITATIONS AND CONTRACT AWARDS

Listed below are procurement invitations and contract awards related to OTEC in particular and ocean resources in general culled from the *Commerce Business Daily*. This is not to be construed, however, as a complete list.

Nov 2: Bibliographic Searches on Technical Subjects Related to Energy Research and Development: Negotiations are being conducted with the New York Times Information Bank. Solicitation DE-AC-01-79-AD-10616.

Nov 2: Bibliographic Searches on Technical Subjects Related to Energy Research and Development: Negotiations are being conducted with the System Development Corporation. Solicitation DE-AC-01-79-AD-10626. Department of Energy, Office of Procurement Operations, Washington DC 20685. Telephone (202) 376-9290.

● **Nov 26: OTEC Cold-Water Pipe At-Sea Program (Fabrication, Development, and Operations):** Fabricate, deploy, operate, and demobilize a normal one-third-scale model of an OTEC cold-water pipe (CWP). The objective of this effort is to provide structural-dynamics information for the validation of dynamic load and stress analysis models being used in the design of the OTEC CWP. The contractor must demonstrate the existence of suitable facilities, administrative personnel, and engineering support to handle the construction, towing, and development of large ocean-based facilities. Firms responding to this announcement should indicate whether they are or are not a minority enterprise. A Pre-Proposal Conference has been tentatively scheduled for 10 am December 17th, 1979. The planned issue date of this RFP is 19 Nov 76. The planned closing date is 7 Jan 80. Solicitation SA-RSD-80-0201. US Department of Commerce, Procurement, Washington DC 20230.

Nov 28: Conduct a Study of Reinforced Concrete Applicable to Floating Marine Structures: Contract DOT-CG-919837-A (CG-919837-A), for $29,108, awarded to Southwest Research Corporation, 6220 Culebra Road, San Antonio, Texas 78284. US Coast Guard, Washington DC 20590.